PPHB
ENERGY INVESTMENT BANKING

MUSINGS FROM THE OIL PATCH

March 6, 2018

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Note: *Musings from the Oil Patch reflects an eclectic collection of stories and analyses dealing with issues and developments within the energy industry that I feel have potentially significant implications for executives operating and planning for the future. The newsletter is published every two weeks, but periodically events and travel may alter that schedule. As always, I welcome your comments and observations.* Allen Brooks

EVs, AVs And TaaS: The Hype Versus Reality

Each technology, if proven commercial and accepted by the public, will impact oil demand, both here in Houston and worldwide

As the Olympics wound down and the Trump/Russian investigation was on hiatus with Congress home, the media was searching for news stories to fill up its white space. *The Houston Chronicle* featured a piece entitled "A surge in electric vehicles," to entertain and educate their energy-industry readers. The tag line to the story – "Pace of growth may be a shock to oil industry," was designed to put a local flavor to the story. Fortunately, the writer didn't feel compelled to employ the "Houston we've had a problem" quote from Astronaut James Lovell on Apollo 13. The Houston energy business is quite aware of the growth in electric vehicles (EVs), the promise of autonomous driving technology, and the ride-hailing Transportation as a Service (TaaS) offering. Each technology, if proven commercial and accepted by the public, will impact oil demand, both here in Houston and worldwide. What is unknown is by how much and over what time-period oil demand will be impacted.

"But it's starting to look more realistic than it did 10 years ago."

As that famous modern philosopher, Yogi Berra, put it, "It's tough to make predictions, especially about the future." Gauging the impact of new technologies on transportation-related oil demand requires making a prediction, which is why we are being inundated by them. Putting the predictions in perspective was commentary by Brett Smith, a senior researcher at the University of Michigan's Center for Automotive Research, who has spent over 30 years studying the auto industry. "There's always this hype curve and we've been through the hype curve on EVs many times. But it's starting to look more realistic than it did 10 years ago."

Probably the initial EV hype was experienced around 1900 when EVs accounted for over 38% of the self-driven vehicles on America's roads. Early auto manufacturers began betting on the long-term success of EVs, as they explored newly emerging markets, such as

The logistics and costs of maintaining a fleet of EV taxis with multiple batteries became too great

urban taxi traffic. The frequent return of taxis to a central facility allowed for frequent battery swaps rather than having the vehicle have to stop while their battery was re-charged. The logistics and costs of maintaining a fleet of EV taxis with multiple batteries became too great, especially at the same time the rise of the internal combustion engine (ICE) eliminated the downtime associated with returning taxis to the central facility for a battery swap.

This made most drives extremely short, which battery power could satisfy

For individuals, EVs were extremely popular with the females in the family as battery power negated the muscular activity of cranking the vehicle's motor to start it. At the same time, the reality at that time was that urban roads ended at the edge of town. This made most drives extremely short, which battery power could satisfy. The great American road construction movement, which began early in the 1900s and enabled people to travel further, when coupled with the introduction of the electric car starter, increased the popularity of ICE vehicles over their EV brethren. These conditions set the course for ICE vehicles to dominate the global auto.

Every recent forecast projecting rapid growth in EV penetration into the vehicle fleet assumes that battery technology will experience a breakthrough, enabling cheaper batteries with much greater range. The breakthrough is key to these forecasts, but the assumption is based on the presumption that the progress in the past will continue and drive down battery costs and increase range.

It lasted 12 seconds at 6.8 miles per hour, covering 120 feet

Wilbur and Orville Wright had been experimenting with powered flight beginning in 1899, but it wasn't until December 17, 1903, that the first manned flight was conducted. It lasted 12 seconds at 6.8 miles per hour, covering 120 feet. The brothers completed three additional flights that day with each one longer and covering a greater distance. The fourth and final flight of the day lasted 59 seconds and covered 852 feet.

From some of these mail service companies emerged the iconic airplane companies of the modern era

From that fledgling effort, modern air transportation was born, however, it was over a decade later before any form of scheduled airline service would begin. From that point forward, partially helped by the influx of pilots from World War I service, first the mail and then passengers began being carried by airplanes. From some of these mail service companies emerged the iconic airplane companies of the modern era – American Airlines (AAL-NYSE), Braniff Airways, Delta Air Lines (DAL-NYSE), Eastern Air Lines, Northwest Airlines, Pan Am, Trans World Airlines and United Airlines (UAL-NYSE), originally a division of Boeing. Passenger air transport grew slowly, but in 1925, the Ford Motor Company (F-NYSE) bought the Stout Aircraft Company and began construction of the all-metal Ford Trimotor, which became the first successful American airliner. With a 12-passenger capacity, the Trimotor made passenger service potentially profitable. Will the EV business follow a similar or faster timetable?

The forces behind the push for EVs, AVs and TaaS are the environmental movement, efforts to declutter city streets, elimination of auto accident deaths, as well as addressing the economic and lifestyle desires of Millennials. A key question for the development of these businesses is how much of the push for the new vehicles and technology comes from government mandates that ignore the products' shortcomings?

The key rationale behind its success is the supposed desire of Millennials to not own or necessarily want to drive cars

In the case of TaaS, the key rationale behind its success is the supposed desire of Millennials to not own or necessarily want to drive cars. Flexible taxi-like services that can be summoned by a cell phone application that handles not only the booking but also the payment including tipping, produce a cleaner vehicle, and possibly a cheaper ride, have grown in popularity. The latest studies on ride-hailing services are offering a sharply divergent view of their value.

The promise of reduced street congestion with the establishment of Uber and Lyft operations has disappeared with the recent study results. One study of 944 ride-sharing users over four weeks in late 2017 in Boston found that nearly six of 10 said they would have used public transportation, walked, biked or skipped the trip if ride-hailing apps were not available. A June study in San Francisco found that on a typical weekday, ride-hailing drivers make more than 170,000 trips, or about 12 times the number made by taxis, and that the trips are concentrated in the most congested parts of the city.

"Ride sharing is pulling from and not complementing public transportation"

A survey released in October of more than 4,000 adults in Boston, Chicago, Los Angeles, New York, San Francisco, Seattle and Washington, D.C., found that 49%-61% of the trips would not have been made, or they would have been done by walking, biking or public transit, if ride-hailing didn't exist. The opinion of one of the study's authors is that "Ride sharing is pulling from and not complementing public transportation." As this is the antithesis of what is envisioned from ride-hailing, the critical observation from a professor who has studied Uber's surge pricing (jacking up prices when demand is the heaviest) concluded, "The emerging consensus is that ride-sharing (is) increasing congestion." If true, for the cities promised to have less congestion, they may need to take other steps like congestion-pricing such as in London and Singapore.

They will be forced to find mass transit services, something we currently call buses

What congestion-pricing of streets does is anger those who are forced to pay for what was previously free or paid for with their taxes. To seriously reduce the congestion, the fee may need to be quite high, which suddenly prices many people, especially low-income workers, out of the market. They will be forced to find mass transit services, something we currently call buses. But, as someone has suggested, the ride-hailing services could move for rider pooling, such as Uber does in Boston, which competes with mass transit in moving people to hubs such as Logan Airport or the South Station railway depot. Will these issues move governments to try municipal ride-hailing services, which will essentially become

mass transit in another form, and at risk of replicating the problems that have plagued existing mass transit in urban locations – poor service at high cost.

We know that weather conditions such as dense fog and heavy snow can confuse sensors

Another problem for AVs that we recently learned about has to do with keeping the sensors clean. For these vehicles to function, they require many sensors placed all over the vehicle to track the landscape, road traffic and other potential hazards as the vehicle navigates its way along the road. We know that weather conditions such as dense fog and heavy snow can confuse sensors, either causing the AV to drive "blind", or causing it to stop. The latter result is likely preferable to driving blind.

Hand washing AVs is the best option

What about dirt? Everyone who drives during rainy or snowy weather can attest to the dirt build-up on their vehicles, which presumably will also be covering the sensors. Run the car through the automatic car wash frequently may be the solution. Oops! It seems that automatic car washes may harm the sensors, causing them to malfunction. So, for now, hand washing AVs is the best option. Companies are working on technologies for cleaning sensors, much like the window washing solution sprayed on our windshields to clean the dirt off. How much solution, and what sort of fluid network will AVs need? A wiper on every sensor? What about if the system runs dry? Solving this issue will merely add to the cost to operate AVs, which are anticipated to be the backbone of TaaS offerings. Because most TaaS systems will be offered by companies with centralized maintenance locations, hand washing can be done, but that process may become a bottleneck on the pace of expansion of TaaS systems, much like battery swapping for the early EV taxis.

Will governments demand complete resolution of the issues before endorsing and allowing them to operate in true commercial modes?

Will issues such as how to keep sensors clean and urban congestion pricing work to limit the universality of AVs and TaaS? If so, the market potential for these technologies will be restricted for some period, depending on the ease and cost of solutions. Will governments demand complete resolution of the issues before endorsing and allowing them to operate in true commercial modes? That requirement doesn't appear to be holding up governments desire to approve the technology. How will the public react when accidents occur? As we like to remind people, 'For every action, there is a reaction.' Understanding that reality helps explain our view that the most optimistic forecasts for AV and TaaS penetration into the economy are probably too optimistic.

Pipeline War Ignites Constitutional Battle Across Canada

Like a prairie wildfire, the battle between Alberta and British Columbia over the construction of a federally-approved crude oil pipeline expansion is raging across the Western Provinces of Canada. The Kinder Morgan Canada Ltd. (KML-T) pipeline

The province recently announced it wanted more data on the handling of bitumen

expansion, which would increase the throughput of the Trans Mountain Pipeline by 590,000 barrels a day of oil coming from Alberta, is struggling to move forward as the British Columbia government delays issuing the required construction permits. The province recently announced it wanted more data on the handling of bitumen, the diluent needed to help flow the viscous oil sands production. The provincial pipeline battle can be viewed from various angles, including the agricultural sector, which turns out to be a unique way to wage a war over oil. At the heart of the dispute, however, is the smooth functioning of Canada's confederation government.

As pointed out in various histories of Canada, the Dominion of Canada developed from a series of conferences and negotiations, as opposed to coming from a revolution or a sweeping fervor for nationalism. The terms of the Confederation were agreed to July 1, 1867. It provided for the union of the British North American colonies of New Brunswick, Nova Scotia and the Province of Canada. From that initial organization, in a slow but steady nation-building exercise encompassing other territories, the dream of a country *a mari usque ad mare* (from sea to sea) was fulfilled.

A driving force for the unity of the Canadian colonies was fear of United States domination

A driving force for the unity of the Canadian colonies was fear of United States domination, and even potential annexation, following the American Civil War. The fear was fed somewhat by the belief that Britain was becoming reluctant to defend its North American colonies against any possible U.S. aggression.

Fear of what might happen to Canada following the end of the American Civil War was stoked by the North's large and powerful army that had just defeated the South

Canadians were shocked by the violence and chaos of the American Civil War. They ascribed the causes of the war partly to a weak United States central government, which prompted consideration that the better governmental form would be a strong central government among the colonies. Fear of what might happen to Canada following the end of the American Civil War was stoked by the North's large and powerful army that had just defeated the South. At the same time, U.S. newspapers were talking about invading and annexing Canada, partly to avenge British support for the American South during the war. Some U.S. politicians openly talked about annexing Rupert's Land, the vast territory that would eventually become Canada's western provinces. America's appetite for expansion was confirmed with the U.S. purchase of Alaska from Russia in 1867.

The movement to form the Confederation grew as political leaders in the various colonies began recognizing the potential risk they faced if the United States decided to try to annex them. A meeting was called for at Charlottetown in Prince Edward Island. The location choice reflected PEI's reluctance to attend a meeting held anywhere else. After the concept of the Confederation was agreed to, there remained much work to be done to spell out the organization and operation of the new governing structure. A month after the

The Resolutions were legalistic and contractual, setting a different tone compared to the American Constitution

Charlottetown conference set the foundation, a meeting was held in Québec, at which time the delegates passed 72 Resolutions, which established the constitutional framework for a new country. The Resolutions were legalistic and contractual, setting a different tone compared to the American Constitution, which had been drafted nearly a century earlier, and driven by a different political dynamic.

Exhibit 1. Founders Of Modern Canada

Source: ***Wikipedia***

The Canadian Resolutions outlined the concept of federalism, with the powers and responsibilities strictly divided between the provinces and the federal government. The Resolutions also outlined the shape of the national Parliament, with an elected House of Commons based on representation by population, and an appointed Senate whose seats would be equally split between three regions: Canada West, Canada East and the Atlantic colonies.

This mandate reflected recognition of the need to improve communications within the nation and to grow it economically

The Resolutions also included specific financial commitments, including the construction by the new federal government of the Intercolonial Railway from Québec to the Maritimes. This mandate reflected recognition of the need to improve communications within the nation and to grow it economically. There was also an acknowledgement that a nationwide railway system would facilitate the movement of troops and weapons if needed to repel an American invasion.

Over the years, Canada grew steadily. In fact, officially established provincial governments spanned the continent merely four years after the formation of the Confederation. Surprisingly, Newfoundland, a neighbor to the colonies that originally formed the Confederation, didn't officially join for 82 years as result of a lack of interest at times in the union, and coincidently, economically bad times when the political will to join was strong.

Exhibit 2. How Quickly Modern Canada Grew

Province	Year
New Brunswick	1867
Nova Scotia	1867
Ontario	1867
Québec	1867
Manitoba	1870
Northwest Territories	1870
British Columbia	1871
Prince Edward Island	1873
Yukon	1898
Alberta	1905
Saskatchewan	1905
Newfoundland	1949
Nunavut	1999

Source: ***Wikipedia*****, PPHB**

The west is the location of most the nation's oil and gas deposits

The nature of the Canadian landscape has shaped how the country evolved. The populous eastern portion of the country is also the seat of much of the country's manufacturing capacity. In the central portion of the country are broad plains where agricultural output is predominant. The west is the location of most the nation's oil and gas deposits. Like the eastern provinces, British Columbia on the west coast has vibrant fishing and forest products industries.

These equalization payments are designed to help guarantee "reasonably comparable levels" of health care, education and welfare in all the provinces

While each province has its unique economic and social strengths, one aspect of the Confederation's operation is the concept of "equalization" payments. The concept was formalized in 1957 and is based on the philosophy that each province should have a similar "fiscal capacity," or the same ability to generate tax revenues. These equalization payments are designed to help guarantee "reasonably comparable levels" of health care, education and welfare in all the provinces. What has been intensely debated over the years is the definition of "reasonably comparable levels."

One shortfall in the calculation is that it is based solely on revenues and does not consider the cost of providing services or the expenditure needs of the provinces

Equalization payments are based on a formula that calculates the difference between the per capita revenue yield that a province would obtain using average tax rates and the national average per capita revenue yield at average tax rates. The objective of the program is to ensure that all provinces have access to per capita revenues equal to the potential average of all ten provinces. The current formula considers five major revenue sources: personal income taxes, business income taxes, consumption taxes, up to 50% of natural resource revenue, and property taxes and miscellaneous. One shortfall in the calculation is that it is based solely on revenues and does not consider the cost of providing services or the expenditure needs of the provinces.

However, because of Alberta's greater wealth, its citizens, on balance, are net contributors to equalization, while the citizens of New Brunswick are net receivers of equalization payments

Equalization payments are essentially transfer payments and happen via the federal treasury. As an example, a wealthy citizen in New Brunswick, a so-called "have not" province, pays more into equalization than a poorer citizen in Alberta, a so-called "have" province. However, because of Alberta's greater wealth, its citizens, on balance, are net contributors to equalization, while the citizens of New Brunswick are net receivers of equalization payments. In most years, the equalization flows have been from the agricultural and mineral rich western provinces to the more populous and manufacturing-heavy eastern provinces. During the recent oil downturn, Alberta shifted from a “have” to a “have not” status, as falling oil prices wiped out substantial wealth in the province.

At the heart of the Alberta/British Columbia political dispute is their attitudes over the development of Canada’s oil and gas resources. Canada has approximately 10% of the world’s proven oil reserves. Total Canadian proven oil reserves are estimated at 171.0 billion barrels, of which 166.3 billion barrels are found in Alberta's oil sands. The remaining 4.7 billion barrels are found in conventional, offshore, and tight oil formations, some of which are in British Columbia. However, Alberta is the dominant producer of the nation’s conventional and tight oil resources. Crude oil and natural gas production in Canada far exceeds the nation’s internal consumption, so much of it is exported to the United States. A very small portion is shipped abroad from the East Coast.

The lower quality of the oil sands output has contributed to it selling at a discount to much lighter U.S. crude oils

For Alberta, the development of its crude oil and oil sands resources has depended on the ability to ship additional output to the United States, most of which goes via large pipelines. The lower quality of the oil sands output has contributed to it selling at a discount to much lighter U.S. crude oils. The growth of oil exports has involved shipping more oil sands volumes. This oil has been the target of environmental attacks because its production and burning releases the largest volume of greenhouse gases of any crude oil.

Both parties campaigned on platforms that they would do everything in their power to block the Trans Mountain pipeline expansion

The most recent environmental strategy to fight the fossil fuel industry has been to target the construction or expansion of pipelines that would move oil sands output. During the Obama era, the construction of the Keystone XL pipeline from Alberta to Texas was fought successfully by the environmentalists. They also fought the construction of the Trans Mountain Pipeline, but the Alberta, British Columbia and federal governments granted approval of its construction. However, that approval was granted before the latest election in British Columbia, in which a minority government led by the New Democratic Party (NDP) and supported by the Green Party is attempting to delay the pipeline’s construction. Both parties campaigned on platforms that they would do everything in their power to block the Trans Mountain pipeline expansion. The new government’s attempt to block the pipeline is pitting Canada’s only two NDP governments against each other. The NDP government in Alberta has already saddled the oil and gas industry with

impediments to growth, but it recognizes it must support the construction of new export pipelines, so the province's green policies don't completely kill the industry with its high-paying jobs.

The lack of new pipeline export capacity will perpetuate the current roughly US$24 a barrel discount between Western Canada Select and West Texas Intermediate

The battle between the two provinces is a part of a wider war between the oil and gas industry and the federal government over its environmental policies, which appear to be manifest through an anti-fossil fuel governing agenda. A recent study by economists at the Bank of Nova Scotia (BNS-NYSE) estimates that the lack of new pipeline export capacity will perpetuate the current roughly US$24 a barrel discount between Western Canada Select (WCS) and West Texas Intermediate (WTI) and cost the Canadian economy C$15.6 billion this year, or 0.75% of its Gross Domestic Product (GDP).

"The sooner governments move to allow additional pipeline capacity to be built, the better off Canada will be"

The economists point out that as more and more oil leaves Canada in railcars, the WCS/WTI discount will shrink. At an estimated US$21/barrel discount, the oil industry's impact on Canada's economy will shrink by roughly C$10.8 billion this year, or 0.5% of GDP, and C$7 billion next year, or an estimated 0.3% of GDP. What this oil price discount does is sap funds from the Canadian oil industry that would be reinvested in new wells. It also reduces the industry's earnings, so tax revenues for Alberta and the federal government will be lower. As the two Scotiabank economists wrote, "The sooner governments move to allow additional pipeline capacity to be built, the better off Canada will be."

Albertans spent C$72 million on B.C. wine last year, with almost 95% of all Canadian wine sold in the province coming from its western neighbor

Alberta Premier Rachel Notley elected to ramp up the economic pressure on British Columbia to try to force it to back off its objections to the pipeline. She moved to ban the importation of B.C. wine into Alberta. The province controls the importation of alcoholic products via the government-owned Alberta Gaming and Liquor Commission (AGLC). Albertans spent C$72 million on B.C. wine last year, with almost 95% of all Canadian wine sold in the province coming from its western neighbor. With the gauntlet thrown down, B.C. responded by challenging the ban through Article 301 of the Canadian Free Trade Agreement (CFTA), which states: "A province shall not adopt or maintain any measure that restricts or prevents the movement of goods across provincial or territorial boundaries."

B.C. wants to be able to dictate what kind and how much oil moves through its province

As pointed out by a newspaper columnist, the irony in the dispute is that B.C. is arguing the AGLC must buy B.C. wine. So, he asked, is there a dollar amount of wine it must buy – one bottle or C$72 million worth? On the other hand, B.C. wants to be able to dictate what kind and how much oil moves through its province in a federally-approved trans-provincial pipeline.

The two-week ban of B.C. wine by the Alberta government, ended a little over a week ago. Its ending was in response to British Columbia Premier John Horgan announcing that his government would seek a court ruling on the question of whether it could implement a temporary ban on increased exports of oil sands

bitumen from Alberta. Premier Notley remarked, “In a small way today, B.C. blinked.” She went on to state, “I’m confident the constitution will be upheld, and we will see the last of these ridiculous threats.”

The science of cleaning up bitumen spills and their environmental damage is well known, so this effort by B.C. appeared to be a stalling technique

The issue that sparked the pipeline battle was B.C.’s proposal to restrict the increased bitumen shipments through the province while it studies the environmental impact of a potential pipeline spill. The science of cleaning up bitumen spills and their environmental damage is well known, so this effort by B.C. appeared to be a stalling technique. The B.C. government is also appealing a decision by the National Energy Board that allowed Kinder Morgan Canada to bypass local regulations in the construction of its pipeline at Burnaby, B.C. Here again, there is a question of whether these are well-founded concerns or delaying tactics.

It is entirely possible that companies operating globally may also find it more expedient to exit Canada, taking their high-paying jobs elsewhere

As Alberta had geared up a panel to devise further responses to the blockage, Premier Notley stated: “If it becomes clear that this action is in fact part of a deliberate strategy to harass the pipeline and its investors with frivolous or unconstitutional legal challenges, we will act immediately." Thus, while a truce in the wine war exists, the battle over the pipeline continues. This leads to the bigger question of the federal government’s approach to shackling the oil and gas industry with rules and regulations, while also not supporting the expansion of the infrastructure necessary to enable more Canadian oil and gas to access international petroleum markets. These policies are lifting the industry’s costs while blocking its access to higher oil and gas prices and increased revenues. Failing to see adequate relief on the horizon, the capital that the Canadian oil and gas industry thrives on will leave, seeking higher returns elsewhere in the world. It is entirely possible that companies operating globally may also find it more expedient to exit Canada, taking their high-paying jobs elsewhere. The federal and provincial governments should consider that once companies decide to exit Canada, their return is never assured, and certainly it won’t be reversed quickly. There will be a long-term economic cost for Canada if it elects to continue to punish its domestic oil and gas business.

The Electrification Of Europe’s Auto Industry Continues

Highlighting how dependent sales are to financial incentives as opposed to competitive market forces

The 2017 scorecard for the electric vehicle market in Europe was recently reported by *EVvolumes.com*. It showed continued increases across the continent, with the lone exception of the Netherlands. There, the data shows what happens when government financial incentives are altered, highlighting how dependent sales are to financial incentives as opposed to competitive market forces.

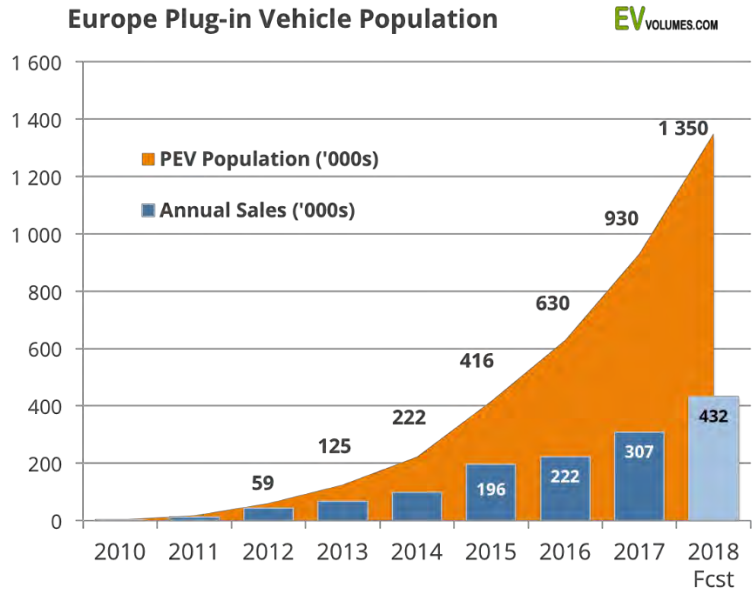
For Europe, 307,400 units of both battery electric vehicles (BEV) and plug-in hybrids (PHEV) were sold in 2017. That was a 39% increase over 2016 sales. Interestingly, the PHEV segment is

Estimates call for around 430,000 electric vehicles to be sold in 2018, a 41% increase

growing the fastest, accounting for 1.74% of total vehicle sales for the full year, over 2% for the final four months of 2017, and reaching 2.55% in the month of December. Estimates call for around 430,000 electric vehicles to be sold in 2018, a 41% increase over last year.

The number of electric vehicles on the continent's road has grown to slightly under one million, up from virtually none just six years ago, reflecting the power of incentives and government concern over climate change.

Exhibit 3. Both EV Sales And Population Are Growing



Source: ***EVvolumes.com***

One can attribute the growth to the financial incentives introduced in late 2016

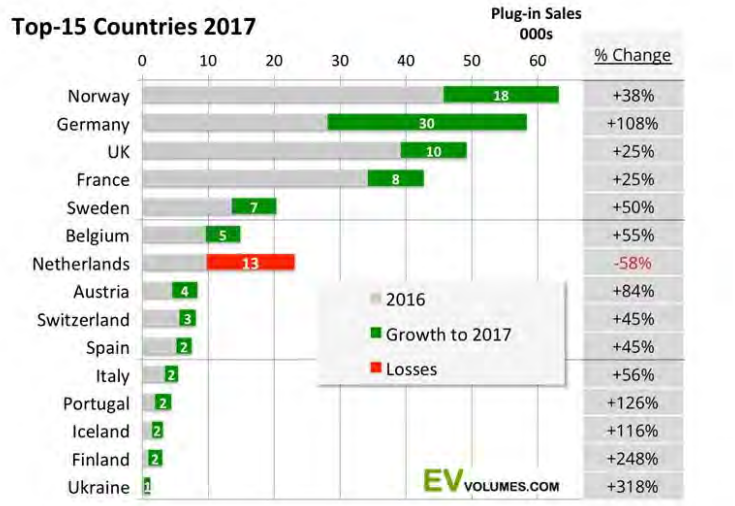
Two things stand out in the sales data. First was the growth in Germany, which appears on the way to becoming the largest plug-in market in Europe and the 5th largest worldwide. One can attribute the growth to the financial incentives introduced in late 2016. This coincided with the emerging diesel emissions scandal of Volkswagen AG (VLKAY-OTC), which infected other German auto manufacturers. The scandal has resulted in the government getting tougher on diesel vehicles and has increased public awareness of the issue, potentially helping accelerate the interest in and sales of electric vehicles.

The second point is the 58% decline in sales of electric vehicles in the Netherlands. This decline reflects a shift in financial incentives provided by the government for the two types of electric vehicles, which influenced the timing of certain purchases as consumers capitalized on the incentives before they were modified. In 2016, the Netherlands reduced the incentives for PHEV sales in favor of

In 2015, the Netherlands was the largest PHEV market in Europe

emphasizing BEV purchases. As a result, there was a rush at the end of 2016 to buy PHEVs, and the subsequent sales decline was not offset by greater BEV purchases. In 2015, the Netherlands was the largest PHEV market in Europe, which shows the sensitivity of electric vehicle markets to specific vehicle incentives.

Exhibit 4. Annual EV Sales Growth By Country



Source: ***EVvolumes.com***

Electric vehicle sales in Norway last year accounted for 32.5% of all vehicles sold, with the share reaching 42% in December

The market data also showed continued strength in the Norwegian electric vehicle market. Electric vehicle sales in Norway last year accounted for 32.5% of all vehicles sold, with the share reaching 42% in December. If one counts only passenger cars, 50% of December's car sales were electrically chargeable vehicles. The extensive and lucrative financial incentives in Norway explains how its market has grown and continues to grow so rapidly.

Last year, BEVs captured 51% of European total plug-in sales, like its share in the United States, but well below China's 80% market share

Examining other sales data shows that PHEVs are predominantly the electrified vehicle of choice in most markets. The data also reflects the uniqueness of each country's financial incentive scheme. Last year, BEVs captured 51% of European total plug-in sales, like its share in the United States, but well below China's 80% market share. Forecasters do not see any change in the BEV/PHEV mix in Europe in 2018, but they acknowledge that financial incentives will favor a long-term trend toward greater electrification of the sales mix, favoring PHEVs. Cited as reasons why this will happen are the tougher vehicle taxation system in Sweden starting in July 2018, and the new emission testing cycle that will necessitate new type approvals, and more likely requiring greater electric range that is likely to further boost BEV prices.

The trend toward increased electric range becomes the final observation about the 2017 electric vehicle sales data. The top

selling electric vehicle models in Europe are those with the greatest electric charge range. The Renault Zoe is Europe's best seller, with 50% more sales than the number two best-selling model, the BMW i3. With a 300-kilometer range per charge, it has the greatest range of any BEV in Europe. The BMW i3 and VW e-Golf saw their sales rise in 2017 after each model offered a 50% increase in battery-charge range. Those sales rates show how sensitive consumers are to range anxiety when selecting an electric vehicle. With a more compact continent and extensive government investment in charging infrastructure, coupled with strong financial incentives and environmental mandates, one should not be surprised by the strength of electric vehicle sales in Europe. As sharply different conditions and attitudes exist in the United States, one would expect range-anxiety to cause greater hesitation on the part of consumers when weighing purchasing an electric vehicle. This is a reason why the U.S. electric vehicle sales growth rate is lower than in Europe.

The BMW i3 and VW e-Golf saw their sales rise in 2017 after each model offered a 50% increase in battery-charge range

Improvement in battery technology may be the most important dynamic dictating the pace of growth for the U.S. electric vehicle market, followed by an increased public charging network. Adding more batteries to extend the range of a vehicle will ultimately be self-defeating as the additional weight will cost range. New battery technology breakthroughs are claimed frequently, but when they are investigated, each potential breakthrough also has a significant limitation. None of the breakthroughs are anywhere near commercial status, but the scientists continue working on them. We will be watching for substantial progress in solving this conundrum.

New battery technology breakthroughs are claimed frequently, but when they are investigated, each potential breakthrough also has a significant limitation

Energy Market Hypocrisy In New England

Russian collusion. According to New England politicians obsessed with the possibility that there was Russian collusion with President Donald Trump and his presidential campaign to meddle in the election, insuring his election, our enemy is Russia. Yet, as a picture in a recent edition of the *Wall Street Journal* showcased, an LNG tanker offloaded its cargo at the Everett LNG terminal in Boston Harbor included natural gas from a Russian project under U.S. government sanctions. You don't find any concern from these same Russian collusion-obsessed politicians about local utilities needing to buy gas from our enemy. Maybe because those politicians fear the blowback if their constituents' lights when out.

You don't find any concern from these same Russian collusion-obsessed politicians

The Everett terminal has been operating for over 40 years, having been built in 1971. It was acquired by ENGIE subsidiary Electrabel in 2000, and then upgraded to enable the terminal to double its distribution capacity. Approximately 81% of the natural gas arriving at the terminal comes from a liquefaction plant in Trinidad. The Everett terminal meets 20% of the region's demand for natural gas, primarily supplying companies and power companies in New England and the Northeast U.S. via pipeline or tanker truck.

The Everett terminal meets 20% of the region's demand for natural gas

Exhibit 5. LNG Tanker Unloading Russian Natural Gas

Source: ***WSJ***

New England is very dependent on natural gas for its electricity generation, as well as for a substantial portion of the home heating market. The Energy Information Administration (EIA) recently produced a chart showing the volume of natural gas purchased by power plants by region of the United States during 2016. The Northeast used 1.6 trillion cubic feet of natural gas, or 17% of the nationwide gas used by power plants. An important point displayed in the chart was how utilities purchased their gas supply – firm contracts, interruptible contracts, or mixed contracts. The Northeast has the lowest percentage of its gas purchased under firm contracts, and the highest percentage in interruptible supply contracts. This contract mix is important when cold weather arrives, something that happens almost every winter. At those times, power companies lose access to their interruptible gas supply, which is diverted to home heating and critical commercial customers. This forces power plants to purchase natural gas in the spot market, or, more likely, to purchase expensive LNG from the Everett terminal.

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The Northeast power market is in transition. It is moving away from coal and nuclear power and towards more renewable energy supplies. These intermittent power sources are forcing utility companies to arrange for natural gas backup supplies. However, the contractual mix for the natural gas used in the region, especially given the inability to expand pipeline capacity into the region, translates into high power costs. As the EIA reports, New England has the highest electricity prices in the nation, averaging 55% above the national average.

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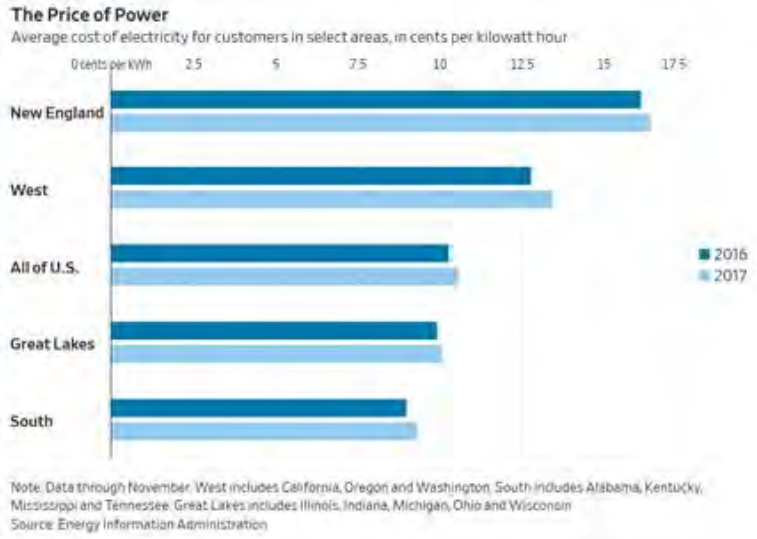
We found the prospect of the arrival of Russian natural gas from a government sanctioned facility interesting. The hypocrisy of local politicians, who fight the construction of new and expanded natural gas pipelines that would eliminate the need for expensive Russian LNG, yet remain quiet when their local utilities buy sanctioned

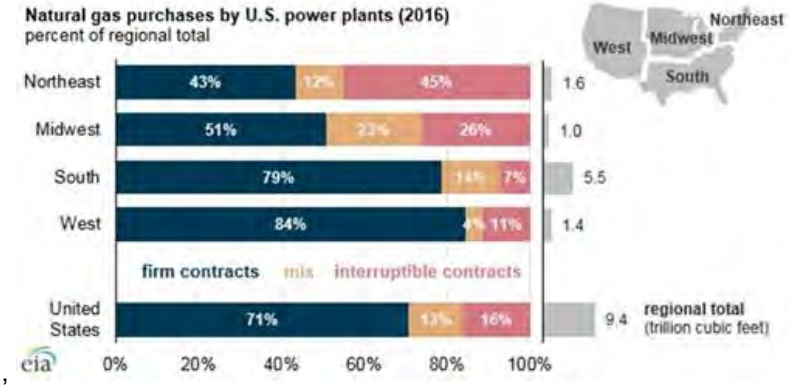
Exhibit 6. New England Has Highest Power Costs



Source: ***WSJ***

gas from the country about which they are outraged for having meddled in the 2016 presidential election, is laughable. The politicians are supportive of environmental opposition to expanding natural gas pipeline capacity, and willing to push high-cost electricity on their citizens, all the while criticizing the bad behavior of Russia, yet happy to buy their natural gas.

Exhibit 7. Few Firm Contracts Inflates Power Costs



Source: EIA

Besides fighting expanded natural gas access, the politicians are pushing green energy mandates that force utilities to purchase expensive renewable energy

Besides fighting expanded natural gas access, the politicians are pushing green energy mandates that force utilities to purchase expensive renewable energy. In Rhode Island, a new natural gas-fired power plant is fought by environmentalists with support of local and national politicians, while the politicians are pushing increased clean energy requirements favoring wind and solar. This pattern of hypocrisy was reflected in the Rhode Island legislature's rewrite of the state's public utility law after the RI Public Utility Commission

(PUC) rejected the Block Island offshore wind farm's application for its power purchase agreement for failing to meet the law's economic thresholds. The rewritten law prevented the PUC from conducting any cost-benefit analysis with regard to wind projects, and forced local utilities to buy only clean energy produced within the state of Rhode Island. The power purchase agreement, with a 20-year life, paid the wind farm developer 24.4-cents/kWh initially, but contains a mandated 3.5% annual price escalator. This deal was struck when the average Rhode Islander was paying 14.4-cents/kWh for his electricity. Recently, the city of Newport petitioned the PUC to examine the local utility placing this expensive clean energy in the distribution charge for residential customers, rather than in the fuel component. This contributes to rapidly rising power bills due to eliminating the benefit of lower cost natural gas as an offset to expensive wind power in the calculation of total fuel costs.

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Renewable energy is not cheap, but that doesn't bother environmentalists. Another renewable program Rhode Island sponsors under its clean energy mandate is the requirement for a certain amount of solar power. Utility companies are purchasing solar power from roof-top arrays. In our case, our electricity provider is paying 34.75-cents per kilowatt hour (kWh) for solar energy produced from our roof-top panels, while charging 16-cents/kWh for the power we consume. Some Rhode Island residents are being paid 41-cents/kWh for their solar power because they joined the program in its initial year, while those joining two years ago earn 37.5-cents/kWh. We have no idea what people who begin selling solar power this year will earn, but we are sure it will be less than our current compensation rate, which is locked in for the next 15 years with a guaranteed renewal at the end of the contract term, although the price to be paid for the solar power will not be determined until that time.

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What we find funny is the fact that the LNG tanker unloading in Boston in late January actually carried gas molecules that originated from Russia's $27 billion Yamal natural gas project in the Arctic. The majority owner of this project is Russian company Novatek, the nation's largest gas producer, with Total (TOT-NYSE) and China National Petroleum each owning a 20% interest in the project. Novatek was sanctioned by the U.S. Treasury Department in July 2014 following Russia's annexation of Crimea and its backing of separatists in eastern Ukraine. The sanctions prohibit financing Novatek projects but not the purchase of its natural gas, according to sanction experts.

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During the January arctic cold snap, the shortage of natural gas in the Northeast due to a lack of pipeline capacity to bring cheaper natural gas from Pennsylvania's Marcellus region, forces power producers to burn expensive LNG and oil. Importing UK LNG came at the same time U.S. gas producers were shipping LNG from Gulf Coast terminals to buyers in South America and Europe.

The gas had already created a furor in the UK over its origin

The LNG cargo did not come directly from Yamal, but instead moved through a series of owners and locations. The ship's cargo originated three weeks prior to its delivery in Boston Harbor at a gas storage facility in Britain called Grain. The gas had already created a furor in the UK over its origin. In Britain, when the cargo was initially shipped from Yamal, the Russian Embassy in London tweeted: "Feeling cold? Help is on the way – first shipment of LNG from Russia arrives in UK today!" To forestall a prospective outrage among British residents, National Grid (NGG-NYSE), the owner of the Grain terminal, announced that the LNG was not needed and would not be used in the UK, but rather would be reexported.

All of these transactions are a reflection of the increasing liquidity in the global LNG market, as it grows and evolves into a commodity market that looks more like the worldwide oil market

As a result, while finding its way to Boston, the LNG cargo changed hands again. This time it was sold to Petronas LNG UK, a British-based unit of the Malaysian energy giant Petronas, according to *LNG World News*. Presumably, it was later resold to ENGIE who owns the Everett LNG terminal in Boston Harbor, or to National Grid, who supposedly is the final consumer. All of these transactions are a reflection of the increasing liquidity in the global LNG market, as it grows and evolves into a commodity market that looks more like the worldwide oil market. The frequent sales in the LNG market will make it more difficult for the U.S. government, or any other western government, to impose penalties for sanction violations.

The politicians in the Northeast are happy to block the development and use of domestic natural gas, while showing no concern about burning gas coming from our leading adversary

The politicians in the Northeast are happy to block the development and use of domestic natural gas, while showing no concern about burning gas coming from our leading adversary. This is not surprising, as those politicians failed to find any problem in the past when Robert F. Kennedy, nephew of the late president John F. Kennedy, was buying deeply discounted heating oil from Hugo Chavez's Venezuela for low income residents in the Northeast. The hypocrisy of our politicians who have no issue in purchasing energy from our adversaries during cold weather, which could have been avoided had they taken actions to boost the domestic energy business, cannot be understated. For some, there is still the message of the 1970s bumper sticker: "Drive Fast. Freeze a Yankee in the Dark."

Spring Approaches, But Offers Little Hope For Natural Gas

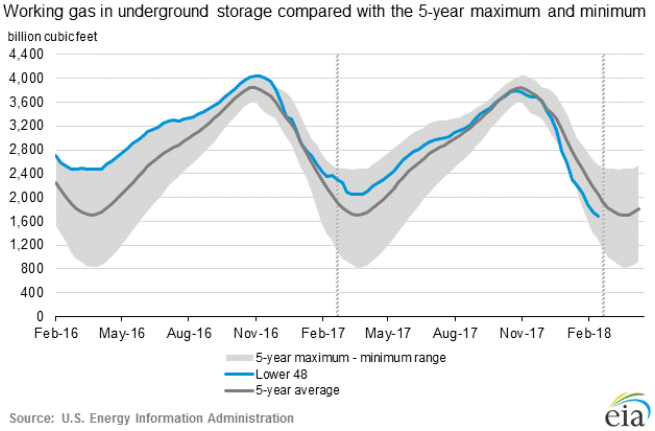
The modest weekly gas storage withdrawals, essentially in line with analysts' forecasts, have contributed to weak gas prices, which are stuck in a narrow range around $2.65/Mcf

Even as new cold fronts sweep across various parts of the United States, there has been little improvement in natural gas pricing as market trends suggest no urgency about refilling supply. Following the record weekly gas storage withdrawal in early January, two weeks later another significant withdrawal occurred, and as a result natural gas prices climbed from $2.80 per thousand cubic feet (Mcf) to $3.20/Mcf on their way to $3.60/Mcf. Since then, the modest weekly gas storage withdrawals, essentially in line with analysts' forecasts, have contributed to weak gas prices, which are stuck in a narrow range around $2.65/Mcf.

The current line is moving away from the 5-year minimum line and toward the 5-year average

Part of the explanation for the weakness in natural gas prices is the condition of current gas storage volumes compared to the 5-year average and the 5-year maximum and minimum range. What we see in the most recent chart published by the Energy Information Administration (EIA) showing weekly gas storage volumes, is that the current line is moving away from the 5-year minimum line and toward the 5-year average. While the amount of deviation from the minimum and the average is small, when the current supply was on the 5-year minimum edge, analysts were concerned about what price would be needed to coax more gas into storage.

Exhibit 8. Current Gas Storage Edging Toward 5-Year Avg.

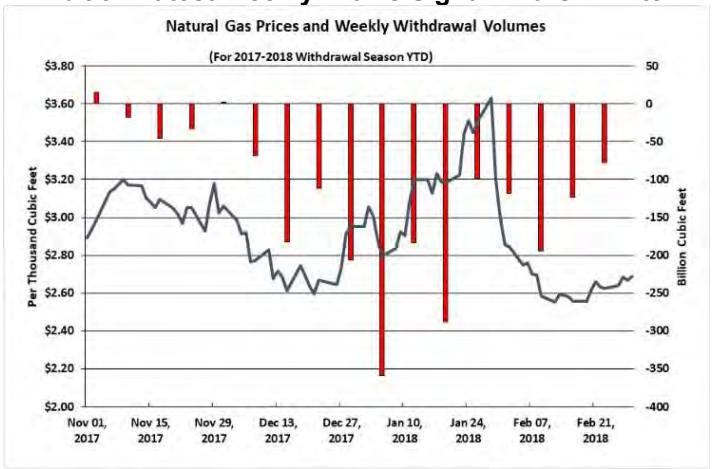


Source: EIA

Each week has brought smaller withdrawals

The message being delivered to the gas market by current natural gas futures prices is that ample supply exists to meet demand. Even though the last three weekly withdrawals have been in line with analysts' expectations, each week has brought smaller withdrawals, likely lulling traders into believing that there is no use being active in

Exhibit 9. Latest Weekly Draws Signal End Of Winter



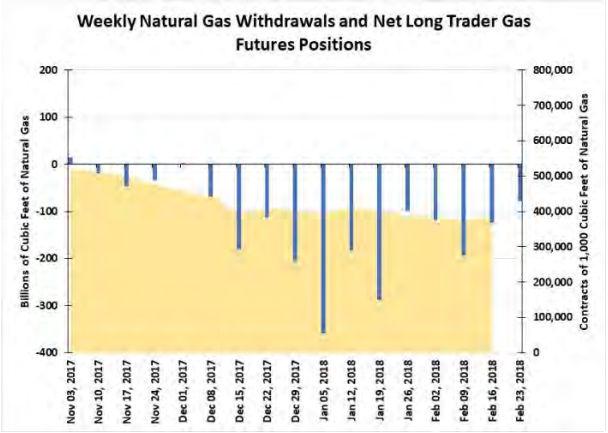
Source: EIA, PPHB

this commodity. As winter draws near, the gas market is heading into the shoulder months for demand – when the weather is just warm enough to negate the need for gas-fired heating, but not sufficiently hot enough to need air conditioning that would put gas-fired electricity generating plants into overdrive. A 'wake me when it's over' mentality is gripping the gas trading market.

Another tell-tale sign of the lack of enthusiasm about natural gas fundamentals has been the decline during the winter in the net long positions of natural gas futures traders

Another tell-tale sign of the lack of enthusiasm about natural gas fundamentals has been the decline during the winter in the net long positions of natural gas futures traders. These are the traders who are most likely to move pricing. Although there was a very slight uptick in the net long position at the end of the week of February 20, 2018, the total net long position reflected a 24% decline from the holdings at November 3, 2017, - the start of the winter withdrawal season. Interestingly, the current net long position is 37.2% below the net long position at the same point in 2017.

Exhibit 10. Trader Interest In Gas Market Waning



Source: EIA, CFTC, PPHB

The current net long position is nearly in the middle of the range of high and low positions seen during March 2016 and March 2017. Optimism for a strong natural gas market existed in late March 2017, as the peak net long position was 75.7% above the current holdings. On the other hand, the current position is 41.5% above the peak low net long position, established the week of March 8, 2016.

As prospects for more extremely cold weather fade, the market will turn its attention to increased exports

What will it take to bring the natural gas market to life? Most likely, given the upturn in shale oil drilling and the growing volumes of associated natural gas output accompanying it, the gas market needs something on the demand side of the equation to improve pricing. As prospects for more extremely cold weather fade, the market will turn its attention to increased exports, either via pipelines to Mexico and/or Canada, or in liquified form. Neither of these export options offer much in the way of near-term hope for demand increases, even though the Cove Point, Maryland LNG export terminal is about to open, with a 5.25-million-tons per year of

Domestic natural gas prices are likely stuck in a $2.50 - $3.00/Mcf range

capacity, or about 1% of domestic production. No one knows if this capacity will be reached. As a result, domestic natural gas prices are likely stuck in a $2.50 - $3.00/Mcf range until the start of next winter. But we can always pray for a blistering hot summer, though global warming doesn't seem to be helping.

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